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| 10/813,409 | 03/29/2004 | Ga-Lane Chen | | 4779 |

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| EXAMINER | |
|---|---|
| BAND, MICHAEL A | |
| ART UNIT | PAPER NUMBER |
| 1709 | |

| SHORTENED STATUTORY PERIOD OF RESPONSE | MAIL DATE | DELIVERY MODE |
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/813,409 | CHEN, GA-LANE | |
| | Examiner | Art Unit | |
| | Michael Band | 1709 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *29 March 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-15* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-15* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *3/29/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *Specification*

1. The disclosure is objected to because of the following informalities: "After the targets 10, 10', 10'' are formed and respectively mounted them on the cathodes 12, 12', 12'', then the target modules 1, 1', 1'' are available for magnetron sputtering" (page 5, paragraph 12). The word "them" should be removed to be grammatically accurate.

Appropriate correction is required.

### *Claim Rejections - 35 USC § 103*

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-3, 7-10, and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lai (US Patent No. 5,593,551) in view of Kulkarni et al (US Patent No. 6,283,357).

With respect to claim 1, Lai '551 discloses "a method of sputtering a selected material onto a generally flat substrate in a conventional magnetron sputtering system" (col. 13, lines 16-18) and where the "vacuum chamber is operated at a low pressure (i.e. evacuated)" (col. 14, line 13). The vacuum chamber pressure is predetermined to be within the "range of about 0.1 millitorr to about 4.0 millitorr" (col. 14, lines 15-16). "A

controlled amount of argon is then introduced into the [vacuum] chamber" (col. 7, lines 37-38) as displayed from figure 1 (parts 20 and 60). The working gas (i.e. argon) pressure is set "between 0.1-4.0 millitorr" (col. 6, line 20). A relatively high "voltage is applied to sputter target assembly" (col. 7, lines 38-39) that initiates the magnetron sputtering process. The target module (i.e. sputter target assembly) "will comprise a layer of material" (col. 6, line 30) "which is bonded to a backing plate" (col. 6, line 31).

However Lai '551 is limited in that while a material is being sputtered from the target, Lai '551 does not specify what type of material the target is composed (i.e. electrically conductive, dielectric, insulator, etc.).

Kulkarni '357 teaches a sputter target material being composed of "a metal, metal oxide, metal silicide or alloy which is to be deposited onto a semiconductor wafer (i.e. substrate)" (col. 3, lines 35-37). Kulkarni '357 further teaches several metals that would compose the target that are electrically conductive, such as copper and gold (col. 7, lines 40-41).

It would have been obvious to one of ordinary skill in the art to use electrically conductive target material taught in Kulkarni '357 as the sputtered target material in Lai '551 in order to gain the advantages of increased substrate conductivity well known in the art and one of ordinary skill would have a reasonable expectation of success in making such a modification.

With respect to claim 2, the references are cited as discussed for claim 1. Lai '551 further discloses that the amount of vacuum pressure be in the "range of about 0.1

millitorr (0.0001 torr) to about 4.0 millitorr (.004 torr)" (col. 14, lines 15-16). This range taught in Lai '551 overlaps with applicant's range.

It has been held that in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976).

With respect to claim 3, the references are cited as discussed for claim 1. Lai '551 further discloses that the gas pressure is held "between 0.1 millitorr (0.0001 torr) to about 4.0 millitorr (.004 torr)" (col. 6, line 20). Applicant claims vacuum pressure is in the range of 0.001 torr to 0.1 torr.

It has been held that in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976).

With respect to claim 7, the references are cited as discussed for claim 1. Kulkarni '357 further discloses that the sputter target is a metal layer (col. 3, lines 35-36) and deposits an electrically conductive layer (i.e. copper or gold) (col. 3, lines 40-41).

With respect to claim 8, the references are cited as discussed for claims 1 and 7. Kulkarni '357 further teaches the target being composed of nickel (col. 3, lines 35-36 and line 44).

With respect to claim 9, the references are cited as discussed for claims 1 and 7. Kulkarni '357 further teaches the target being composed of copper (col. 3, lines 35-36 and line 40).

With respect to claim 10, the references are cited as discussed for claims 1 and 7. Kulkarni '357 further teaches the target being composed of stainless steel (col. 3, lines 35-38, line 41). Kulkarni '357 states that the target may be made of a high purity chromium (col. 3, lines 35-38 and line 41). It is well known that stainless steel is composed of at least 10-12% chromium alloyed to iron (col. 3, line 42) and trace amounts of carbon. Other metals such as nickel (col. 3, line 44), molybdenum (col. 3, line 41), copper (col. 3, line 40), tungsten (col. 3, line 40), and cobalt (col. 3, line 41) may also be alloyed to chromium to give certain chemical properties. Kulkarni '357 further states that these metals may be alloyed (i.e. stainless steel) to form a target plate (col. 3, lines 35-36 and lines 45-48).

With respect to claim 15, Lai '551 discloses "a method of sputtering a selected material onto a generally flat substrate in a conventional magnetron sputtering system" (col. 13, lines 16-18) and where the "vacuum chamber is operated at a low pressure (i.e. evacuated)" (col. 14, line 13). The vacuum chamber pressure is predetermined to be within the "range of about 0.1 millitorr to about 4.0 millitorr" (col. 14, lines 15-16). "A controlled amount of argon is then introduced into the [vacuum] chamber" (col. 7, lines 37-38) as displayed from figure 1 (parts 20 and 60). The working gas (i.e. argon) pressure is set "between 0.1-4.0 millitorr" (col. 6, line 20). This pressure is held by a "control means for monitoring the pressure within the vacuum chamber" (col. 6, lines 23-24). A relatively high "voltage is applied to sputter target assembly" (col. 7, lines 38-39) that initiates the magnetron sputtering process. The target module (i.e. sputter target

assembly) "will comprise a layer of material" (col. 6, line 30) "which is bonded to a backing plate" (col. 6, line 31).

However Lai '551 is limited in that while a material is being sputtered from the target, Lai '551 does not specify what type of material the target is composed (i.e. electrically conductive, dielectric, insulator, etc.).

Kulkarni '357 teaches a sputter target material being composed of "a metal, metal oxide, metal silicide or alloy which is to be deposited onto a semiconductor wafer (i.e. substrate)" (col. 3, lines 35-37). Kulkarni '357 further teaches several metals that would compose the target that are electrically conductive, such as copper and gold (col. 7, lines 40-41).

It would have been obvious to one of ordinary skill in the art to use electrically conductive target material taught in Kulkarni '357 as the sputtered target material in Lai '551 in order to gain the advantages of increased substrate conductivity well known in the art and one of ordinary skill would have a reasonable expectation of success in making such a modification.

4. Claims 4-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lai (US Patent No. 5,593,551) and Kulkarni et al (US Patent No. 6,283,357) as applied to claim 1, and further in view of Heeks et al (US Patent No. 6,559,593).

With respect to claim 4, the references are cited as discussed for claim 1. However neither Lai '551 nor Kulkarni '357 teach a specific flow rate for argon. Heeks '593 discloses that "argon is generally used as the discharge (i.e. working) gas in sputtering processes" (col. 2, lines 32-33). Heeks '593 further discloses that neon gas

can also be used due to it having less molecular weight (col. 2, lines 33-36). Heeks '593 states that apparatus has a flow rate of neon, or argon, gas at "25 SCCM" (col. 5, line 60).

It would have been obvious to one of ordinary skill in the art to use the flow rate of Heeks '593 as the flow rate in Lai '551 since Lai '551 fails to disclose a specific flow rate and one of ordinary skill would have a reasonable expectation of success in making the modification.

With respect to claim 5, the references are cited as discussed for claim 1. Lai '551 discloses that the sputtering apparatus uses "various power supplies" (col. 6, line 8) and a power source must be applied to the target taught in Kulkarni '357 in order to sputter the target material. However both Lai '551 and Kulkarni '357 are limited in that they do not specify what type of power source (i.e. DC or AC) is applied to the target.

Heeks '593 teaches a method of sputtering deposition of multiple layers utilizing a power source applied to a target using a direct current (col. 5, line 27) for a similar sputtering apparatus with a magnetron and target assembly inside a vacuum chamber. It would have been obvious to one of ordinary skill in the art to use the direct current in Heeks '593 as the power supply in Lai '551 since Lai '551 fails to disclose a specific power supply and one of ordinary skill would have a reasonable expectation of success in making the modification.

5. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lai (US Patent No. 5,593,551) and Kulkarni et al (US Patent No. 6,283,357) as applied to claim

1, further in view of Harada et al (US Patent No. 6,803,098) and Chiang et al (US Patent No 6,893,541).

With respect to claim 6, the references are cited as discussed for claim 1. Lai '551 further discloses a high voltage is applied to the sputter target assembly (col. 7, lines 38-39), and that "such a voltage maybe of the order of several hundred volts" (col. 7, lines 40-41). Since a voltage is being applied to the target, thus a power density is being generated.

However modified Lai '551 is limited in that it does not disclose a specific power density present.

Harada '098 teaches a similar sputtering apparatus with a magnetron and target assembly inside a vacuum chamber. A power density present on the "target during sputtering is usually from 1 to 20 W/cm$^{2}$" (col. 3, lines 38-39). Applicant claims the power density range of 20 and 70 W/cm$^{2}$. It has been held that in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976).

It would have been obvious to one of ordinary skill in the art to use the power density of Harada '098 as that generated in Lai '551 since Lai '551 fails to disclose a specific power density and one of ordinary skill would have a reasonable expectation of success in making the modification.

Modified Lai '551 is also limited in that it does not disclose a specific voltage.

Chiang '541 teaches a direct current sputter magnetron having a power supply that applies about 400 to 600 volts to the target during sputtering (col. 1, lines 43-45).

Applicant claims the voltage is between the range 200 and 1000 volts. It has been held that in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976).

It would have been obvious to one of ordinary skill in the art to use the applied voltage of Chiang '541 as that generated in Lai '551 since Lai '551 fails to disclose a specific applied voltage and one of ordinary skill would a reasonable expectation of success in making the modification.

6. Claims 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lai (US Patent No. 5,593,551) and Kulkarni et al (US Patent No. 6,283,357) as applied to claim 1, further in view of Harada et al (US Patent No. 6,803,098).

With respect to claim 13, the references are cited as discussed for claim 1. However Lai '551 and Kulkarni '357 are limited in that while both sputter onto a substrate, the specific material of the substrate is not taught.

Harada '098 further discloses a substrate sputtered with a metal oxide is a synthetic resin substrate having thermoplastic properties (col. 4, lines 7-11). The thermoplasticity gives the substrate better adhesion to sputtered, metallic layers (i.e. copper, nickel, and stainless steel).

It would have been obvious to one of ordinary skill in the art to use the synthetic resin substrate taught in Harada '098 as the substrate in Lai '551 in order to gain the advantages of increased adhesion for sputtered, metallic layers well known in the art

and one of ordinary skill would have a reasonable expectation of success in making such a modification.

With respect to claim 14, Harada '098 further discloses that said resin may be a "polystyrene resin" (col. 4, line 20).

7. Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lai (US Patent No. 5,593,551) and Kulkarni et al (US Patent No. 6,283,357) as applied to claim 1, and further in view of Hata (US Patent No. 4,971,674).

With respect to claim 11, the references are cited as discussed for claim 1. However Lai '551 and Kulkarni '357 are limited in that both describe only utilizing one target as compared to multiple, distinct targets.

Hata '674 discloses a magnetron sputtering apparatus contained inside a vacuum chamber utilizing "a composite target consisting of a plurality of partial targets" (col. 1, lines 19-20) used for the formation of a multilayer film on a substrate. Figure 7 displays a single target piece (part 2). The partial targets are on this singular piece, but are arranged concentrically with each partial target being of a single composition (col. 10, lines 29-33) to make the thickness distribution of films formed on a substrate uniform (col. 2, lines 63-64).

It would have been obvious to one of ordinary skill in the art to use the composite target taught in Hata '674 as the target in Lai '551 in order to gain the advantages of making the thickness distribution of films formed on a substrate uniform well known in the art and one of ordinary skill would have a reasonable expectation of success in making such a modification.

With respect to claim 12, Kulkarni '357 further discloses a sputter target composed of "a metal, metal oxide, metal silicide or alloy" (col. 3, lines 35-36). Kulkarni '357 further teaches that copper (col. 3, line 40) and nickel (col. 3, line 44) may be used on the composite target. Although not specifically stated, stainless steel is also described as a possible component for the target as discussed in claim 10.

***Conclusion***

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Oyama et al (US Patent No. 6,344,288).

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Band whose telephone number is (571) 272-9815. The examiner can normally be reached on Mon-Fri, 8am-4pm, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on (571) 272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

10. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a

USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

MAB

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SUPERVISORY PATENT EXAMINER